

# **Aeronautical P25 Digital VHF-FM Radio Transceivers**

## **FS/AMD A-19, Revision E**

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This document specifies the minimum performance specifications for all fire certified conventional P25 digital aeronautical mobile VHF-FM radio transceivers used in conjunction with United States Department of Agriculture Forest Service (USFS) and United States Department of the Interior (DOI) fire operations.

### **1.0. Specifications**

All transceivers shall be specifically designed for aircraft use and meet all applicable RTCA, Inc. and Federal Aviation Administration requirements for transceivers operated in aircraft. Federal Communications Commission (FCC) testing must be re-accomplished on a completed aeronautical mobile radio if modified third party transceiver(s) are incorporated into the aeronautical radio. This will ensure any third party FCC approved transceivers continue to meet FCC requirements after modifications.

#### **1.1. Transceiver Characteristics**

The transceiver shall operate from 136.0000 to 173.9975 MHz, have at least one main transceiver, have at least one guard receiver, and be TIA TSB-102 APCO Project 25 (P25) digital compliant.

- A. **Main Transceiver.** The main transceiver shall be frequency synthesized. The main transceiver shall be able to operate on any channel and meet the operational characteristics in the National Telecommunications and Information Administration (NTIA) and FCC basic channeling plans for the VHF-FM 136.0000 to 173.9975 MHz frequency band.
- B. **Guard Receiver.** The guard receiver shall be synthesized. The guard receiver shall have a transmit frequency paired with it. The guard receiver and transmitter shall meet the same requirements as the main receiver and transmitter but operate on 168.6250 MHz. Examples of how multiband P25 digital transceivers may meet this requirement are by having a second conventional VHF-FM P25 digital receiver dedicated for Guard use or a VHF-FM trunked channel preset to conventional P25 digital simplex to meet the Guard requirement.
- C. **P25 Digital.** The main transceiver shall be conventional P25 digital compliant by meeting TIA TSB-102 standard. The mode of operation (analog wideband, analog narrowband, and digital narrowband) shall be operator selectable by channel.

## 1.2. Channel/Frequency Selection

Channel and frequency selection shall be provided to permit the operator to select all of the following:

- A. In all modes. Preset channel, frequency, frequency pair, bandwidth, and operating mode while in flight.
  - B. Analog mode. All standard Continuous Tone Controlled Squelch System (CTCSS) frequencies while in flight. The transceiver shall be capable of having any CTCSS tone (or no tone) programmed by the operator into any assigned frequency.
  - C. P25 Digital mode. Network Access Code (NAC) and TalkGroup ID's (TGID) while in flight. The transceiver shall be capable of having any valid NAC and TGID programmed by the operator into any assigned frequency.
  - D. The only exception is the guard receiver and transmitter frequencies. Modifying these preset settings should be limited to a special sequence where errant re-programming of the guard preset is unlikely.
- 1.3. Channel Presets. The minimum number of operator selectable preset channels for the main transceiver shall be 100 and one preset for the guard receiver. Preset channels shall contain receive and transmit frequencies, and appropriate CTCSS, NAC, and TGID codes in analog, digital, wideband, or narrowband modes. Alpha-numeric characters shall be available for entry by the operator for designating channel labels.
- 1.4. Guard Receiver. The frequency of 168.6250 MHz shall be simultaneously monitored with the main frequency for guard reception. Scanning of the guard frequency is not acceptable.
- 1.5. Guard Transmit. A means of quickly selecting a preprogrammed guard transmitter frequency shall be provided (e.g. a main/guard toggle switch). The transceiver shall transmit a CTCSS tone of 110.9 Hz on the guard frequency.
- 1.6. Transmitter. Single band VHF-FM transceivers shall be capable of transmitting 10 watts nominal. Multi-band transceivers shall be capable of transmitting no less than 6 watts and no more than 10 watts nominal. The transmitter shall not be capable of operation of more than 10 watts nominal.
- 1.7. Time Out Timer. A selectable (on/off) 90 second time out timer shall be available.
- 1.8. CTCSS Operation. CTCSS code frequencies shall meet the standards of ANSI/TIA-603 (as revised) for all standard CTCSS code frequencies.

## 1.9. Operating Standards

The transceiver shall conform to applicable sections of 14 CFR Parts 23 and 27. Specifically §23.1309, §23.1431, and §27.1309. All transceivers shall meet the following RTCA DO-160 specifications:

- A. Specific transceivers approved using RTCA DO-160C  
Control Heads and Panel Mounted Transceivers:  
DO-160C Env. Cat. [A1]BAA[MN]XXXXXXABBBBAUAXXX  
Remote Mounted Transceivers:  
DO-160C Env. Cat. [B2]BAA[MN]XXXXXXBBBBBAUAXXX
- B. Transceivers approved prior to December 5, 2002  
RTCA DO-160D through Change 2  
Control Heads and Panel Mounted Transceivers:  
DO-160D Env. Cat. [A1Z]BAA[(SM)(UFF1)]XXXXXXABBBA[UUU]M[XXXX]XXA  
Remote Mounted Transceivers:  
DO-160D Env. Cat. [B2Z]BAA[(SL)(UFF1)]XXXXXXBBBBBA[UUU]M[XXXX]XXA
- C. Transceivers approved from December 5, 2002 to December 4, 2004.  
RTCA DO-160D, Change 3  
Control Heads and Panel Mounted Transceivers:  
DO-160D Env. Cat. [A1Z]BAB[(SBM)(UG)]EXXXXXZZBZA[RR]M[XXXXX]XXA  
Remote Mounted Transceivers:  
DO-160D Env. Cat. [B2Z]BAB[(SCL)(UG)]EXXXXXAZBZA[RR]M[XXXXX]XXA
- D. Transceivers approved after December 4, 2004.  
RTCA DO-160E  
Control Heads and Panel Mounted Transceivers:  
DO-160E Env. Cat.  
[A1Z]BAB[(SBM)(UG)]EXXXXXZZBZ[AC][RR]M[XXXXX]XXAC  
Remote Mounted Transceivers:  
DO-160E Env. Cat. [B2Z]BAB[(SCL)(UG)]EXXXXXAZBZ[AC][RR]M[XXXXX]XXAC
- E. All transceivers certified to DO-160 categories other than those listed must prove that those categories meet or exceed applicable categories.
- F. It is preferred that DO-160 environmental category 9.0, Explosive Atmosphere Test, Cat A be used for Environment II applications in lieu of Cat E.

Note: Previously approved multimode transceivers with significant engineering upgrades must have appropriate DO-160 tests reaccomplished using current standards.

## 2.0. General Requirements

### 2.1. Conventional P25 Digital Programming:

- A. Presets: All main transceiver preset channels shall be operator programmable, while in flight, utilizing transceiver front panel controls. The main and guard receivers shall not be disabled during programming. Programming shall not require that the transceiver be turned off, then on, to reinitialize the transceiver with updated information.
  - B. Guard Frequency: Guard frequency programming and edit functions should be disabled during normal programming operations to ensure that the guard preset frequency assignment remains undisturbed during main frequency programming operations. Guard information in multiband transceivers dedicated to Guard operation may be programmed via a computer in lieu of front panel programming.
- 2.2. Audio Input Sensitivity. The audio required to fully modulate the transmitter shall not exceed that normally produced by the aircraft's audio system and/or microphone. Audio impedance shall be designed for a 600 ohm aircraft audio system.
- 2.3. Transmit Sidetone Audio. Sidetone audio shall be provided to permit the operator to monitor audio input to the transmitter and to assist the operator with word annunciation during high ambient noise conditions. The sidetone adjustment shall be accessible to aircraft maintenance personnel or the operator without disassembling the transceiver.
- 2.4. Display. The transceiver shall simultaneously display the channel number in use, and either the seven character frequency in use (i.e. 166.6750) or an operator programmable eight character alphanumeric channel designator (i.e. AIR/GND1). Controls and the display shall meet human factor needs and have a minimum acceptable viewing angle of  $\pm 80^\circ$ . The display shall be easily visible in direct sunlight from a distance of 36 inches.
- 2.5. Volume Controls. Single band VHF-FM transceivers shall have separate volume controls for the main and guard receive audio outputs. The audio outputs shall be combined as a single output. Multi-band transceivers may utilize common volume controls(s) and separate audio output(s).
- 2.6. Primary Power. A primary power on/off switch shall be provided.
- 2.7. Indicators. Indicators shall be provided to indicate transmitter activation and signal reception for all transceivers.
- 2.8. Squelch Override. A squelch override (squelch defeat) switch shall be provided to the operator for audio testing and volume level adjustment.
- 2.9. Scanning. Scanning should be accomplished as follows:
- A. Scanning shall be enabled/disabled by the operator on a per channel basis.

Channel sampling intervals shall be of sufficient duration as to monitor the channel being scanned but no more than 2 seconds before sampling the next channel.

- B. A talkback feature shall allow the operator to respond to scanned receiver communications. Once the transceiver has detected an incoming transmission, the transceiver shall automatically pause on that channel for between 3 to 5 seconds allowing the operator to reply to the received message. If the transceiver detects no further incoming radio traffic after approximately 2 seconds and the operator discontinues transmissions on the scanned channel, the transceiver shall automatically resume scanning.

### **3.0. Leading Particulars**

- 3.1. Finish. The front panel shall be standard avionics nonreflective flat black or gray in color.
- 3.2. Front Panel. The front panel shall be a backlit panel operable from the avionics dimming bus.
- 3.3. Identification Tag. An identification tag containing all required markings will be permanently affixed to the exterior of each unit for quick identification.
- 3.4. Labeling. All controls shall be clearly and permanently labeled and shall be easily discernible whenever the backlit panel is illuminated.
- 3.5. Mounting. Standard DZUS mounting is preferred for all panel mounted transceivers and control heads. In all cases transceiver equipment shall be able to be mounted securely and withstand applicable DO-160 tests for the mounting method used.
- 3.6. Input power. Positive +24 VDC operation is required. The transceiver frame shall be ground.

### **4.0 Acceptable Aeronautical Mobile VHF-FM Radio Transceivers.**

- 4.1 Transceivers currently meeting these requirements are posted at:  
<http://www.nifc.gov/NIICD/documents.html>
- 4.2. The following aeronautical mobile VHF-FM radio transceivers are known to meet these requirements:

Cobham (Northern Airborne Technology)	NPX136D-070
Technisonic Industries	TDFM-136
	TDFM-136A
	TDFM-136A/NV